

## REMARKS

### Formal Matters

A) Drawings-Attached to the end of this amendment are annotated and substitute sheets showing Figures 1 and 2. As suggested in the office action, Figures 1 and 2 have been amended to include the annotation "Prior Art". Please enter the substitute drawing sheet in the case.

B) Specification-The undersigned disputes the position that substitute specification and claims filed with the application should not be entered and are not entered in the case. A review of the USPTO web site shows that the substitute specification and claims are entered in the case (see U.S. Patent Publication 2007/0138580). These revisions were properly entered (and should be entered by the Examiner) as the implement amendments made at the international stage.

Assuming arguendo that the Examiner's position is correct, attached are annotated and clean copies of the patent specification. As pointed out in the office action, the annotated and clean copies are not accompanied by the claims, but implement the same changes which were made in the patent application as originally filed with the addition of the change in the title to the title proposed by the Examiner in the office action. The amendments implement those which were made at the international stage. Furthermore, it is noted that the published application implements these same amendments (see 2007/0138580). To the extent that these amendments are not of record, please enter the substitute application in the case. However, if amendments are already entered in the case as is indicated by the published application, then amendment of the title only is requested.

C) Claims-While the Examiner has acted on the claims in the translation filed with the published PCT application, the published application at the USPTO implements the amendments made at the time the application was filed (see 2007/0138580) (and which were made during the international stage). This amendment amends the claims in the translation (1-31) so that they reflect the same claims which were provided in the substitute specification at the time of filing. To the extent that these claims are not of record, please implement the changes noted above. However, if the claims are as presented in the published

application (20070138580), please make no amendments in the claims, and, further, please apply the remarks below to the relevant claims.

The amended claims herein (or the amended claims as presented at the time the application was filed), are patentable over the references of record for the reasons noted below. The remarks below reflect the claim numbers noted above. To the extent the Examiner's position concerning entry of the amended claims is correct, the amendments above present claims that satisfy the requirements of 37 CFR 1.75 (a) (claims 21, 27-30) and which conform to US practice.

With respect to the provisional amendment above, new claims 32-39 have been added; claims 1, 8, and 9 have been canceled, and claims 2-7, 10-12, 20-23, 27, and 30-31 have been amended with payment for 36 total claims and 13 independent claims. It is noted that U.S. Patent Publication 2007/0138580 has these same 36 total claims and 13 independent claims. In view of this prior payment, it is believed that no additional fees are required to gain entry of this amendment. However, if additional fees are required, the Commissioner is authorized to charge attorney's deposit account 50-2041. (Whitham, Curtis, Christofferson & Cook).

#### Substantive Matters

Claims 1, 2, 8, and 9 were rejected as being anticipated by U.S. Patent Publication 2003/0143825 to Matsuo. Claims 3-7 were rejected as being obvious over Matsuo in view of U.S. Patent Publication 2005/0280104 to Li and U.S. Patent 7,098,516 to Colombo. Claims 1-20, 22-26 and 31 have been rejected as being anticipated by U.S. Patent Publication 2006/0258156 to Kittl. Each of these rejections is traversed.

A. Claims 1-9 rejected based on Matsuo alone or in combination with Li and Colombo

Claim 1 has been canceled. Base claim 32 is presented for consideration. Base claim 32 requires that the

gate electrode contains nickel silicide as a primary constituent, and has a region through which said gate electrode makes contact with said gate insulating

film and which has a composition expressed with  $\text{Ni}_x\text{Si}_{1-x}$  ( $0 < X < 1$ ), and said X is greater than 0.5 ( $X > 0.5$ ) in said nickel silicide contained in a gate electrode formed above a p-channel, and said X is equal to or smaller than 0.5 ( $X \leq 0.5$ ) in said nickel silicide contained in a gate electrode formed above a n-channel.

As is recognized by the Examiner, U.S. Patent Publication 2003/0143825 to Matsuo shows a tungsten silicide gate electrode 111. Paragraph [0070] does NOT describe substituting nickel for tungsten in the gate electrode as erroneously suggested in the office action. Rather, paragraph [0070] makes clear that a reaction is carried out between the tungsten silicide film 111 and another metal film 112, and a nickel film can be used in place of not the tungsten silicide film 111, but the tungsten film 112 provided over the tungsten silicide film 111—thus, it is clear that 111 is a tungsten silicide film, not a nickel silicide meeting the requirements set forth in claim 32.

As such, Matsuo does not anticipate 32 or its dependent claims, and the rejection for anticipation by Matsuo should be withdrawn. Furthermore, with reference to new claims 33-39, it can be seen that the claims each specify a gate electrode that is not tungsten silicide. Thus, none of these claims are anticipated by Matsuo.

The Examiner has relied upon Li and Colombo as teaching a gate insulator which includes hafnium silicon oxynitride. However, it will be recognized by the Examiner that neither Li nor Colombo make up for the deficiencies of Matsuo with respect to base claim 32, i.e., neither reference shows

said X is greater than 0.5 ( $X > 0.5$ ) in said nickel silicide contained in a gate electrode formed above a p-channel, and said X is equal to or smaller than 0.5 ( $X \leq 0.5$ ) in said nickel silicide contained in a gate electrode formed above a n-channel.

Furthermore, neither Li nor Colombo show this relationship for X for n-channel or p-channel gate electrodes for any of the other metal silicides set forth in claims 33-39.

Thus, a case of *prima facie* obviousness has not been established, as MPEP 2142 requires that in order to establish a *prima facie* case of obviousness, the prior

art references must teach or suggest all the claim limitations. In view of this, the rejection for obviousness should be withdrawn.

B. Claims 1-20, 22-26 and 31 with respect to Kittl.

At the outset, it will be recognized by the Examiner that the PCT filing date of the present application, which designated the US, was June 21, 2005. In contrast, the filing date of Kittl was May 15, 2006, nearly one year after the effective U.S. filing date for the present invention. The Examiner's statements suggest that he may be relying on the provisional patent application date for Kittl (USSN 60/681,821 filed May 16, 2005). This provisional application, of course, was filed approximately one month before the present PCT application, but it is filed nearly 11 months after the priority date of the PCT application (JP 2004-184758 was filed June 23, 2004). If need be, the applicant reserves the right to file an English language translation of the Japanese priority document to demonstrate that the present application has a superior filing date to the Kittl reference such that any rejection based on Kittl should be withdrawn.

However, as a separate matter, the applicant notes that the claimed invention is NOT anticipated by Kittl. At best, the Examiner may rely on the provisional application of Kittl in addressing the claims, because, ONLY, the provisional application as a filing date prior to the filing date of the present PCT application. The undersigned has attached hereto a copy of the text of USSN 60/681,821 which was obtained from the USPTO PAIR database. It can be seen that this provisional application is comprised of what appears to be the text of two journal articles on which Kittl is a joint author. The Examiner will recognize that considerably more information appears in U.S. Patent Publication 2006/0258156 to Kittl than appears in USSN 60/681,821 to Kittl, AND, that none of this additional information can properly be recognized as prior art to the claimed invention.

With reference to the specification of USSN 60/681,821 it can be seen that the two articles relate exclusively to Ni silicided (FUSI) gate electrodes for CMOS applications. These articles do not show any other metal silicide gate electrodes. As such, claims 33-39 are NOT anticipated by Kittl.

With reference to the specification of USSN 60/681,821 it can be seen that the articles describe a NiSi interface that is overcoated with a Ni-rich silicide. See particularly Figure 2 on page 4 of USSN 60/681,821. In contrast, claim 12 of the present application requires at least a region of said gate electrode making contact with said gate insulating film is composed of silicide containing Ni<sub>3</sub>Si phase as a principal constituent. As such, claim 12, and dependent claims 13-20 are NOT anticipated by Kittl.

Similarly, wholly absent from USSN 60/681,621 is any teaching of removing a portion of said nickel film which was not turned into said nickel silicide, by etching,  
wherein a ratio of a thickness TNi of said nickel film to a thickness TSi of said poly-silicon is defined as  $1.60 \leq T_{Ni}/T_{Si}$ .

This is expressly required in claim 31. Therefore, claim 31 is not anticipated by Kittl.

Also, wholly absent from USSN 60/681,621 is any teaching of removing a portion of said nickel film which was not turned into said nickel silicide, by etching,  
wherein said nickel film has such a thickness t1 above a p-channel device that, when poly-silicon and nickel react with each other to make nickel silicide, said nickel silicide has Ni<sub>3</sub>Si phase as a principal constituent, and has such a thickness t2 above a n-channel device that, when poly-silicon and nickel react with each other to make nickel silicide, said nickel silicide has one of NiSi phase and Ni<sub>3</sub>Si phase as a principal constituent.

This is expressly required in claims 23. Therefore, claim 23 and its dependent claims are not anticipated by Kittl.

Also, wholly absent from USSN 60/681,621 is any teaching of removing a portion of said nickel film which was not turned into said nickel silicide, by etching,  
wherein said nickel film has such a thickness t1 above a p-channel device that, when poly-silicon and nickel react with each other to make nickel silicide, a portion of said nickel silicide making contact with said gate insulating film has composition expressed with Ni<sub>x</sub>Si<sub>1-x</sub> ( $0.6 \leq X < 1$ ), and has such a thickness t2 above a n-channel device that, when poly-silicon and nickel react with each other to

make nickel silicide, a portion of said nickel silicide making contact with said gate insulating film has composition expressed with  $Ni_xSi_{1-x}$  ( $0 < X \leq 0.5$ ).

This is expressly required in claim 22. Therefore, claim 22 is not anticipated by Kittl.

Likewise, wholly absent from USSN 60/681,821 is any teaching of removing a portion of said one of metals which was not turned into said silicide, by etching.

assuming that said one of metals is expressed with M, and said silicide has a portion through which said silicide makes contact with said gate insulating film and which has a composition expressed with  $M_xSi_{1-x}$  ( $0 < X < 1$ ).

wherein said metal M has such a thickness t1 above a p-channel device that, when poly-silicon and said metal M react with each other to make silicide, a portion of said silicide making contact with said gate insulating film has composition expressed with  $M_xSi_{1-x}$  ( $0.5 < X < 1$ ), and has such a thickness t2 above a n-channel device that, when poly-silicon and said metal M react with each other to make silicide, a portion of said silicide making contact with said gate insulating film has composition expressed with  $M_xSi_{1-x}$  ( $0 < X \leq 0.5$ ).

This is expressly required in claim 21, therefore claim 21 is not anticipated by Kittl.

Finally, with respect to page 6 of the office action, it is noted that the Examiner has suggested that because Kittl shows gate electrodes made from nickel silicide, and that these materials can have different phases including NiSi and Ni<sub>3</sub>Si, depending on how they are handled, then one type of silicide ( $x = 0.75$ ) could be used for PMOS application, and another type ( $x = 0.5$ ) could be used for NMOS applications. This suggestion cannot be found in USSN 60/681,821. Furthermore, it is not even present in US2006/025816 to Kittl (which, as noted above, is not a reference in the case).

Claim 32 requires

said X is greater than 0.5 ( $X > 0.5$ ) in said nickel silicide contained in a gate electrode formed above a p-channel, and said X is equal to or smaller than 0.5 ( $X \leq 0.5$ ) in said nickel silicide contained in a gate electrode formed above a n-channel.

This is not present in the Kittl reference. If the Examiner persists in this

conclusion, the Examiner is requested to identify this teaching by page and line number with reference to USSN 60/681,821. In fact, with reference to Figure 2 on page 4 of USSN 60/681,821, as well as the abstract, it can be seen that an NiSi layer is positioned at the interface and a layer of Ni rich silicide is positioned above it. At no point does Kittle suggest or describe an X value for the silicide that is different from a p channel than an n channel, much less the specific values required in claim 32.

In view of the foregoing, it is respectfully requested that the application be reconsidered, that claims 2-7, 10-12, and 20-39 be allowed (or, in the alternative, claims 1-36 of U.S. Patent Publication 2007/0138580 be allowed), and that the application be passed to issue.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

A provisional petition is hereby made for any extension of time necessary for the continued pendency during the life of this application. Please charge any fees for such provisional petition and any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 50-2041.

Respectfully submitted,



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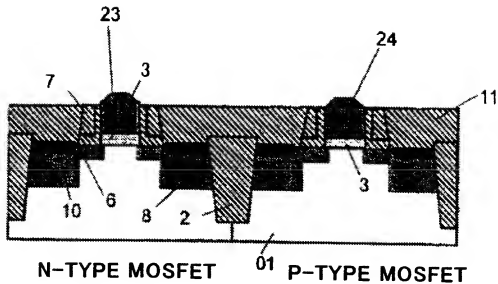
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ANNOTATED AND SUBSTITUTE  
DRAWINGS



[FIG.1]

PRIOR ART



[FIG.2]

PRIOR ART

